

A radiation evaluation was performed on **The OP77AZMDA Next Generation OP07 Ultra low Offset Voltage Operational Amplifier (Analog Devices)** to determine the total dose tolerance of these parts. The total dose testing was performed using a  $\text{Co}^{60}$  gamma ray source. During the radiation testing Five parts were irradiated under bias, see figure 1. One part was used as a control sample, but due to an oversight of the test engineer the control was only tested prior to irradiation. The total dose radiation levels were 1, 5, 10, 15, and 20kRads(Si). The average dose rate was 4.9rads(Si)/min. After the 20krad(Si) irradiation, the parts were annealed under bias at 25°C for 168 hours. After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits listed in Table III. An executive summary of the test results is provided below in bold, followed by a detailed summary of the test results after each radiation level and annealing step.

**At the 10krad(Si) radiation step two devices (DUT2 & DUT3) exceeded the maximum specified Maximum limit of positive bias current (2.0nA) by 2.25nA & 2.13nA, although the mean was within spec (1.91nA). At the 15krad(Si) radiation step, all devices and the mean exceeded the specified Maximum limit of negative and positive bias current of 2.0nA. The devices continued to degrade at the 20krad(Si) step, the devices did not recover after a 168 hour biased room temperature Anneal.**

**At the 10krad(Si) radiation step two devices (DUT1 & DUT3) exceeded the maximum specified Maximum limit of negative bias current (200pA) by 2.33nA & 2.73nA, although the mean was within spec (1.47)**

**For Input Offset Current all devices were with in the manufacturers datasheet requirements, at all radiation levels. At 20krad(Si) two devices (DUT2 & DUT3) exceeded the 25μV specified maximum of the input offset voltage by 3μV & 53μV, the devices recovered after 168 hour room temperature biased anneal.**

Initial electrical measurements were made on 6 samples. Five samples were irradiated electrical measurements made. All devices had the following external markings on the package: 5962-98802PA; OP77; 3B0402F  
All devices and the mean met the manufacturer's datasheet maximum for positive input bias current.

Table IV provides a summary of the test results with the mean and standard deviation values for each parameter after each irradiation exposure and annealing step.

TABLE I. Part Information

<b>Generic Part Number:</b>	OP77
<b>Full Part Number</b>	OP77AZMDA
<b>Manufacturer:</b>	Analog Devices
<b>Lot Date Code (LDC):</b>	3B0402F
<b>Quantity Tested:</b>	5
<b>Serial Numbers of Control Samples:</b>	
<b>Serial Numbers of Radiation Samples:</b>	1, 2, 3, 4, 5,
<b>Part Function:</b>	OPAMP
<b>Part Technology:</b>	Bipolar
<b>Package Style:</b>	8-pin can
<b>Test Equipment:</b>	HP4156B Precision Semiconductor Parameter Analyzer; HP E3611A DC Power Supply
<b>Test Engineer:</b>	C. Palor / A. Pham

\* The manufacturer for this part guaranteed no radiation tolerance/hardness.

TABLE II. Radiation Schedule for OP77AZMDA

EVENT.....	DATE
1) INITIAL ELECTRICAL MEASUREMENTS .....	1/4/2005
2) 1 KRAD IRRADIATION (XX RADS (Si)/MIN).....	1/4/2005
POST-1 KRAD ELECTRICAL MEASUREMENT .....	1/4/2005
3) 5 KRAD IRRADIATION (93RADS (Si)/MIN) .....	1/4/2005
POST-5 KRAD ELECTRICAL MEASUREMENT .....	1/4/2005
4) 10 KRAD IRRADIATION (4.9RADS (Si)/MIN) .....	1/5/2005
POST-10 KRAD ELECTRICAL MEASUREMENT .....	1/5/2005
5) 15 KRAD IRRADIATION 6.84 RADS (Si)/MIN).....	1/5/2005
POST-15 KRAD ELECTRICAL MEASUREMENT .....	1/5/2005
6) 20 KRAD IRRADIATION (114 RADS (Si)/MIN) .....	1/5/2005
POST-20 KRAD ELECTRICAL MEASUREMENT .....	1/5/2005

Average Dose Rate = 4.9 rads (Si)/min

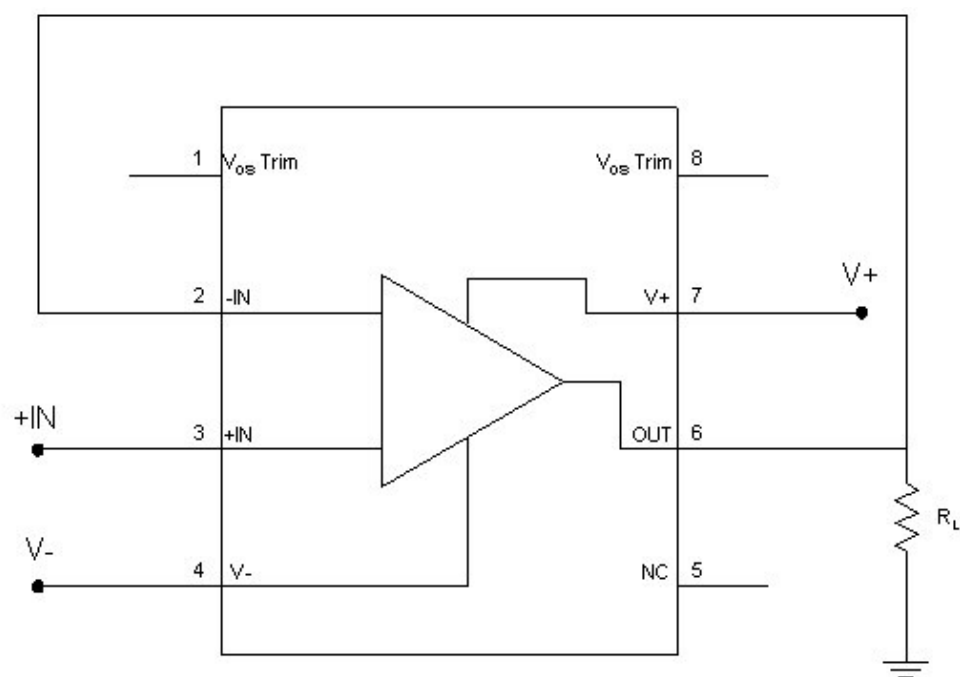


Figure 1. OP77AZMDA Bias Circuit

Table III. Electrical Characteristics OP77AZMDA

Total Dose Exposure																		Annealing	
Test #	Spec. Lim. (2)					Initial		1kRads (Si)		5kRads (Si)		10kRads (Si)		15kRads (Si)		20kRads (Si)		168 hours @25°C	
	Parameters	condition	Units	min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	+IB	Vs = ±15 V, TA = 25 deg. C	nA	-0.20	2.00	0.84	0.06	0.88	0.09	1.25	0.13	1.91	0.26	4.70	0.99	4.29	2.79	6.03	0.99
2	-IB	Vs = ±15 V, TA = 25 deg. C	nA	-0.20	2.00	0.78	0.08	0.80	0.12	1.19	0.40	1.47	0.99	2.59	1.91	4.48	1.56	3.45	1.14
3	I <sub>o</sub>	Vs = ±15 V, TA = 25 deg. C	nA	--	--	0.06	0.01	0.08	0.09	0.06	0.38	1.47	0.99	0.06	0.38	4.48	1.56	2.57	0.59
4	V <sub>IO</sub>	Vs = ±15 V, TA = 25 deg. C	mV	--	25.00	-70.00	51.64	-60.00	22.36	-50.00	0.00	-150.00	0.00	-30.00	44.72	-10.00	54.77	-110.00	54.77
5	V <sub>SWING</sub>	Vs = ±15 V	V	±12	--	±14.46	2.20E-03	±14.46	1.64E-03	±12.60	4.18E+00	12.94297	3.40337	±14.46	1.04E-03	±14.46	1.29E-03	±14.47	1.15E-03